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Geotechnical, Flooding and Stormwater Desktop Assessment for Proposed School Development

1043 Linwood Road, Kingseat

Job No: 20198 | Revision B | Dated 15 May 2020

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Geotechnical Engineering Ltd
T/A Soil & Rock Consultants

GEOTECHNICAL, OLFP FLOODING AND STORMWATER DESKTOP ASSESSMENT FOR PROPOSED SCHOOL DEVELOPMENT 1043 LINWOOD ROAD, KINGSEAT

Job Number:	20198
Name of Project:	Desktop Assessment
Client:	Ministry of Education - Auckland
Authors:	Geotechnical: Randy Lineses, Senior Geotechnical Engineer OLFP & Stormwater: Chloe He, Civil/Environmental Engineer
Reviewer:	Sean Berry, Senior Hydrogeologist / Engineering Geologist, MSc Geology
Authoriser:	Zeljko Viljevac, MSc (Geology), Senior Hydrogeologist / Engineering Geologist
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Appendix

1.0 Introduction

Soil & Rock Consultants (S&RC) were engaged by the Ministry of Education (Auckland; MoE, *the client*), to prepare an updated desktop assessment for proposed school development in 1043 Linwood Road, Kingseat.

The purpose of the desktop study is to:

- Evaluate the proposed school site with regards to potential hazards (geotechnical, stormwater and flooding) that may affect the proposed development.
- Give an indication of the scope of future investigations (i.e. geotechnical, stormwater and flooding) required for the proposed re-development.
- Assist the client's 'due diligence' study.

This assessment has been prepared to supplement the earlier desktop report prepared in August 2018 (for potential school sites within the general area – Job No 18430, Rev A) with focus on the specific site described above.

1.1 Scope and Brief

Our assessment is based solely on information gathered from geological maps, a review of previous S&RC geotechnical investigation reports and publicly available historic aerial images (Auckland Council Geomaps, Retrolens, Google Earth).

Our brief did not extend to a site walk-over inspection or sub-surface investigation in the form of hand augerholes, machine boreholes or digger test pits or formal (computer based) stability assessments. It follows that any desk-top study recommendations will be high-level only and an intrusive investigation and assessment will be required to confirm the assumptions and conclusions presented in this report.

1.2 Limitations

This report has been prepared for the sole benefit of our Client, the Ministry of Education, in respect to 1043 Linwood Road, Kingseat and the particular brief given to us. The data and/or opinions contained in this report may not be used by any other party or for any other purpose without our prior review and agreement and this report may not be used to support applications for Resource Consent or Building Consent for future works.

2.0 Site Description

The proposed school development is situated to the north western section of 1043 Linwood Road in Kingseat, being an area of approximately 4.44 ha. The property is legally designated as Lot 2 DP 417814. We understand that the extent of the land holding on which the school will be located is Section 1 of the attached title plan in Appendix A. The proposed school development will be referred to as 'the site' in this report.

Built development within the site is comprised of buildings (dwelling and sheds), fences, gravel access and carparking. Vegetation on site comprises grass, shrubs, trees and hedges in places. Based on Council Geomap website, ground surface on site is gentle, generally no steeper than 8° from horizontal.

Overland flow paths (OLFP) are present on site, and are discussed further in Section 6 of this report.

An aerial photograph of the site, from Auckland Council Geomaps website, with contour and OLFP information overlain is shown in Figure 1 below.

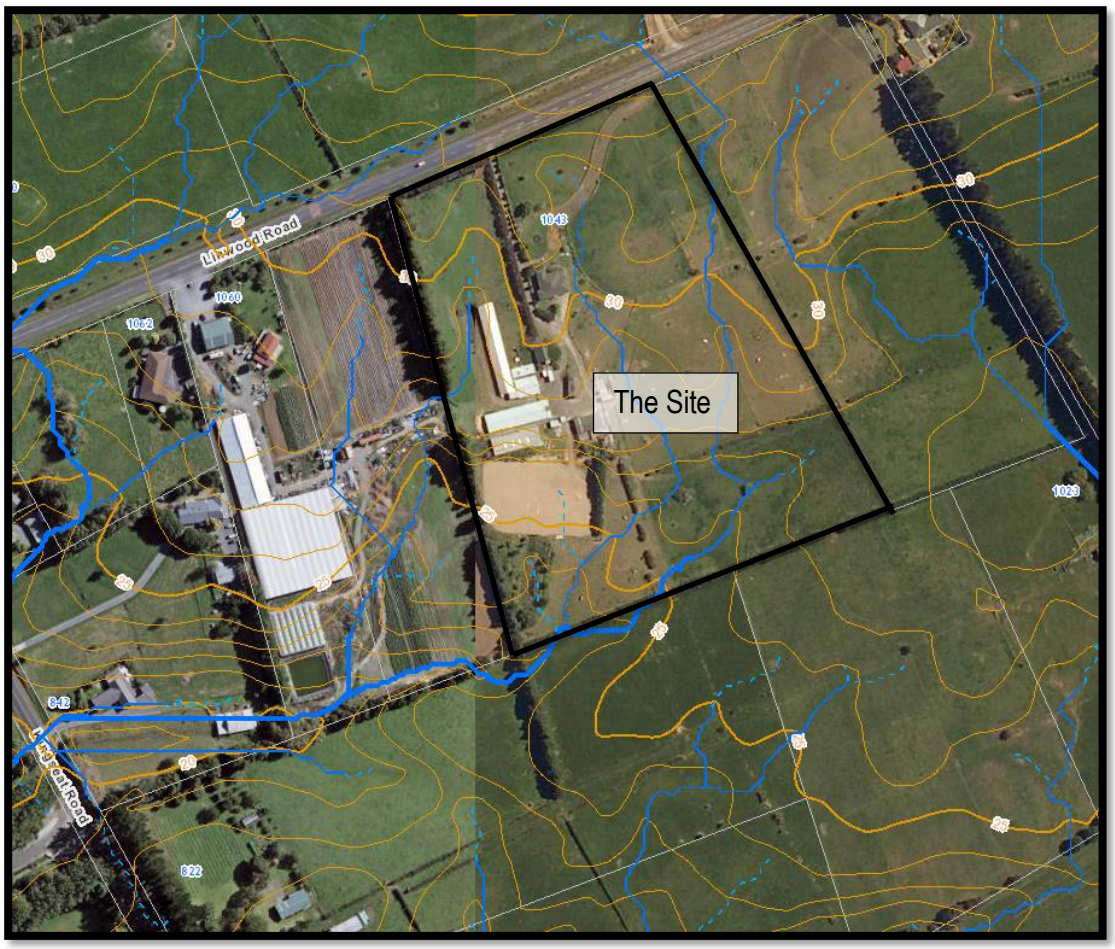


Figure 1: The Site

3.0 Soil & Rock Consultants Previous Investigations

S&RC have not carried out field investigations within any of the subject sites however we have previously carried out several geotechnical investigations and stormwater designs within the wider Kingseat and nearby areas.

Reference has been made to the previous field investigation data in preparation of this report, including our previous desktop assessment as referenced in Section 1.0. Our previous investigations indicate that the area is underlain by alluvial deposits. Volcanic soils (tuff) have also been encountered in places, generally overlying the alluvial soils, associated with the South Auckland Volcanic Field located approximately 7km to the south.

4.0 Review of Publicly Available Aerial Imagery

Publicly available historic aerial images have been sourced from Auckland Council GIS services (Geomaps), the Retrolens Historical Image Resource website and historical images from Google Earth. The historic images were reviewed for features that could indicate ground alteration or significant geotechnical features. The available aerial images date between 1942 and 2017 and are appended to this report.

No significant changes to land topography were observed from the historic images of the site.

With reference to Geomaps hydrologic information Overland Flow Paths (OLFPs) are present within the site.

5.0 Geotechnical Desk Study

5.1 Geology

According to the New Zealand Geology Web Map (extract shown in Figure 2) the general area is underlain by Puketoka Formation deposits of the Tauranga Group of Pliocene to Pleistocene age. These soils are described as light grey to orange brown pumiceous mud, sand and gravel with black muddy peat and lignite.

These soil deposits are generally variable in strength ranging from soft to very stiff and are typically over consolidated or normally consolidated. They have been deposited for a longer geological time scale than any more recent localised alluvial deposits and therefore are generally more consolidated and of higher strength.

Geotechnical hazards associated with alluvial deposits are soft, loose, and saturated soils with peat deposits. These materials can be prone to undue consolidation settlement and are also susceptible to seasonal shrinking and swelling as a result of moisture changes.

In addition to soft soils considerations, potential for flooding also often forms a hazard where such materials are present.

It is common in the Kingseat area to encounter a mantle of weathered volcanic ash overlying the alluvial deposits. This mantle may be up to 1.5m thick (typically 1.0m to 1.2m).

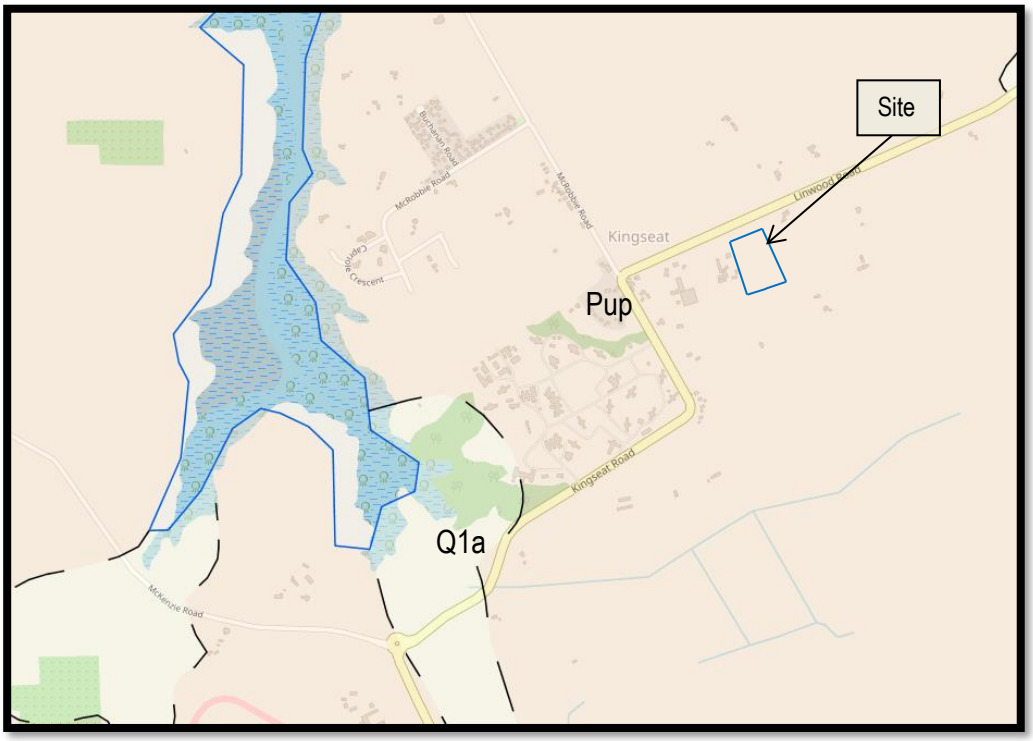


Figure 2: Geological Map

(Source: 'New Zealand Geology Web Map, 1:250K Geology, GNS website')

Legend

- Pup = Puketoka Formation (Tauranga Group)
- Q1a = Undifferentiated Alluvium (Tauranga Group)

5.2 Geotechnical Considerations

5.2.1 Soil Types

The volcanic ashes are inorganic and usually favourable for the support of typical school buildings. Where inorganic (i.e. free from appreciable peat deposits), the alluvial soils are also suited to typical construction.

Both soil types can be sensitive to elements (e.g. sun, rain, wind) and disturbance, sometimes significant loose of strength is observed when exposed to the elements, disturbed by excavations, or trafficked by construction plant. This can cause difficulties with earthworks and pavement construction however can be addressed by thoughtful construction procedures and techniques.

Alluvial deposits sometimes contain peat or saturated layers, usually found beneath a mantle of stiffer soils. Each can cause issues associated with consolidation settlement following earthworks or building construction. This can be addressed in a number of ways including pre-loading of soils and piling. The merits of the potential mechanisms can be addressed when the actual soil conditions are determined by intrusive investigation and preliminary site development and building plans are available.

5.2.2 Slope Stability

No appreciable indications of landform instability were noted in the historic aerial images. Based on Geomaps LIDAR contours, no steep ground slopes are present within the site.

Future developments are anticipated to be within near level or gently sloping ground, and consequently potential instability is not considered an issue. If future development is required in close proximity to any ground slopes greater than approximately 14˚ from horizontal (not apparent with respect to available terrain data), engineering solutions to mitigate against slope instability should be expected.

5.2.3 Future Geotechnical Site Investigations

Based on the information and data gathered, a future geotechnical site investigation is required for a typical school development. A preliminary scale is indicated below:

- Hand augerholes within building footprints. A minimum of three or four hand augerholes on each building footprint.
- Scala penetrometer tests from the base of the augerholes, and from ground surface in driveway areas (for CBR correlation).
- Test pits using a hydraulic excavator within fill areas where augerholes prove to be not possible due to obstructions.
- Rotary machine core drilling and/or CPT Testing to characterise deeper geological units for potential pile foundation embedment, particularly if:
    - Hand-investigations show peat or other weak/compressible soils are present at shallow depth

  - Proposed buildings are heavy or of brittle construction. This includes typical school buildings that are of concrete construction and of two or more levels, typically including a concrete mid-floor.
- Collection of soil samples for Shrink/Swell Testing in a soil laboratory.

It should be noted that the above is based on the inferred geology of the site. Actual ground conditions may vary from our currently inferred model and require different types of testing. In any case, hand augerhole investigations should be carried out initially to determine actual near surface (<5m) ground conditions and assist with determination of the most appropriate type of machine-drilled investigation if required.

5.3 Geotechnical Summary

The main points of the geotechnical part of this report are summarized below:

- The geology present across the sites is Puketoka Formation deposits of the Tauranga Group of Pliocene to Pleistocene age. Volcanic ash may also be present.
- Fill should be expected on site, particularly within and around the existing structures. The depth and quantity of the fill is unknown.
- Puketoka Formation soils can include weak saturated soils and peats, usually below a surface mantle of stiff inorganic soils.
- Alluvial soils can be sensitive to elements (e.g. sun, rain, wind) and disturbance. Sometimes losing significant strength when exposed to elements and by excavations or trafficked by construction plant.
- A number of different investigation techniques could be used depending on the location and scale of any development proposed. A preliminary handauger investigation coupled with preliminary development design would indicate the type and scale of subsequent machine investigations required (if necessary).
- We have not identified obvious geotechnical constraints within any of the proposed sites that are expected to either preclude the development of a typical school, cause significant development/foundation design issues, or incur significant costs to overcome potential constraints. Such issues may be revealed by in-ground investigations, hence our recommendations regarding further fieldwork.

6.0 Hydrology Desktop Study

6.1 OLFP Desktop Study

The Overland Flow Path (OLFP) flooding desktop study is based on publicly available information on the Geomaps platform. OLFP flooding features are shown in Figure 3 below:

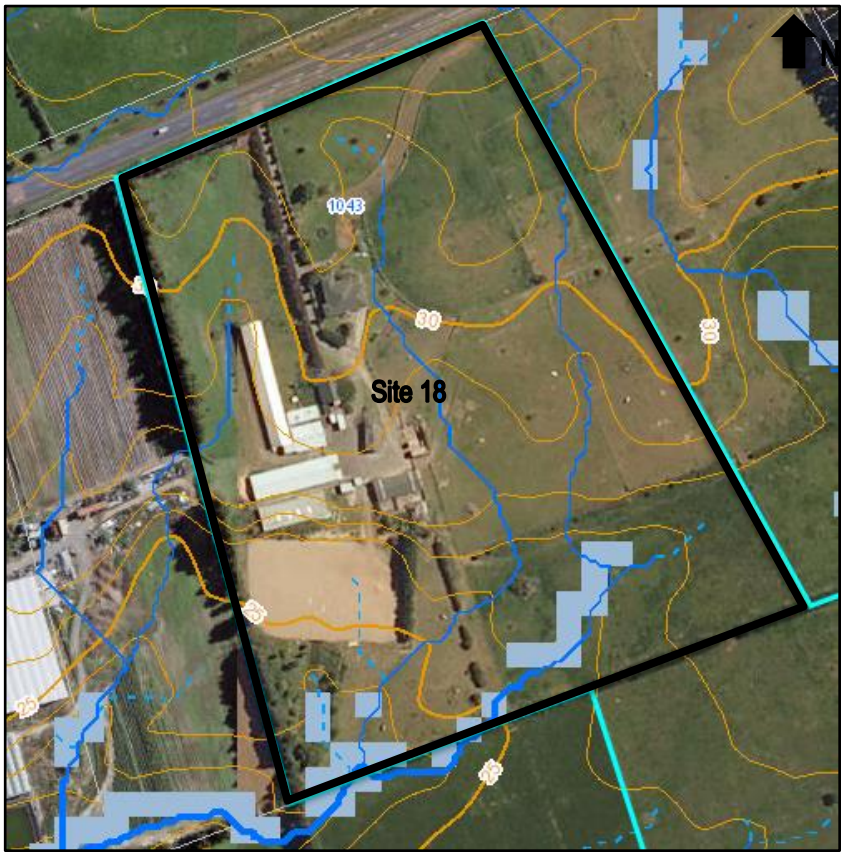


Figure 3: **Overland Flow Paths, Flood Plain and Flood Prone Area**

(Source: https://geomapspublic.aucklandcouncil.govt.nz)

Northern half of 1043 Linwood Road, Kingseat (Lot 2 DP 417814)

Three OLFPs are identified within the site (northern half of 1043 Linwood Road, Kingseat):

- All OLFPs are flowing from the north to south;
- The first OLFP (approximate catchment area of 0.67ha) is present within the western part of the site flowing across the middle of the western site boundary;
- Two of the OLFPs (approximate catchment areas between 2.11ha and 3.10ha) are present within the eastern half of the site, and are associated with a 100-year ARI flood plain at the southern and south-western corner of the site to an elevation between RL 23m and RL 27m;
- OLFPs present within the site are likely to be wide and shallow channel flow;
- Identified OLFPs merge together at the south-eastern corner of the neighboring property at 1060 Linwood Road;

- Flooding risk within the site is considered to be minor, and is likely to be present predominantly at the south-western part of the site.

We have reviewed the received feasibility sketch of the school development (by ASC Architects dated 22 April 2020). Preliminary desktop review comments in relation to the OLFPs are:

- The three OLFPs are likely to be slightly obstructed by the currently provided feasibility sketch as shown in Figure 4,however the detailed development design is considered likely to differ from the feasibility sketch in order to OLFP manage site constraints. The potential impact on any future detailed development would largely be in respect to the development layout. Avoiding obstruction of the OLFPs and minimizing the impact of the OLFPs should be taken into consideration during the detailed design process in order to suitably manage the OLFP.
- OLFP diversion and conveyance assessment through the outdoor courtyard area/space between the buildings would be required to confirm the potential flood level and capacity for flow passage for each OLFP in relation to the proposed building (i.e. post-development site condition). Open channel swale will likely be required for OLFP diversion.
- A Hazard Risk Assessment in relation to the proposed development is required in accordance with the Auckland Unitary Plan (AUP) E36.9. (2), and will need to include (at a minimum):
    - identification of the scale, frequency, and flow velocity of the OLFPs; assess potential flood risk to the proposed School;
    - Assessment of access, exit and safe evacuation routes of the proposed buildings during flood events;
    - identification of site specific mitigation measures if any.

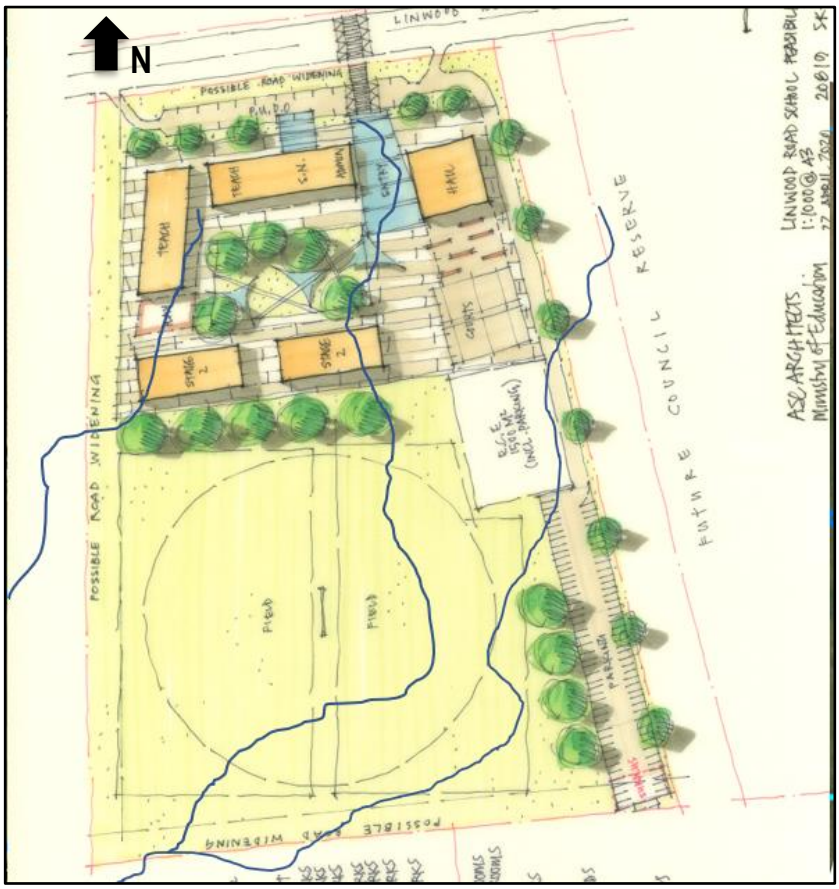


Figure 4: **Feasibility Sketch with Overland Flow Paths**

6.2 Stormwater Management Desktop Study

Reference made to the Geomaps indicated that no stormwater reticulation network is available in the area at the time of this report preparation. If insufficient public stormwater infrastructure is in place at the time the school development proceeds, stormwater management and discharge for the proposed development should be carried out within the site with the following methodology:

- Capture all roof runoff into rainwater tanks for water supply of the site;
- Number of rainwater tanks is subject to the proposed roof area;
- Runoff from the paved area could be collected by cesspit with inline filtration device and treated via either grass swale or raingarden;
- Runoff from the paved area should be directed into raingarden(s) for treatment and attenuation prior to discharge;
- The number and size of raingardens is subject to the contributing paved area and proposed development layout;
- Overflow from the rainwater tanks and stormwater management device could be discharged to the lower part of the site (i.e. south) via a dispersal trench(es).

6.3 Hydrology Summary

Based on the desktop assessment, we consider the following from an OLFP flooding and stormwater management perspective:

- The potential flooding risk within the site is considered to be minor. The flood potential is likely to be spatially restricted to within a small portion of the site.
- OLFP diversion assessment and design will be required in relation to the currently received feasibility sketch of the proposed development layout.
- The potential impact on future detailed development is considered likely to differ to the provided feasibility sketch, and would largely require variation in respect to the development layout. Avoiding obstruction of the OLFPs and minimising the impact of the OLFPs should be taken into consideration during the detailed design process in order to suitably manage the OLFP.
- A site specific OLFP hazard risk assessment will be required in accordance with E36.9. (2) of AUP to assess potential OLFP risk to the proposed school building, and to detail safe access, exit and evacuation route during flood events.
- Stormwater discharge from the proposed development can be carried out within the site if insufficient public stormwater infrastructure is in place at the time the school development proceeds.
- Stormwater runoff can be managed and treated via rainwater tanks, grass swale, raingarden and/or dispersal trench.
- Stormwater management device layout and sizing is subject to the proposed development layout and contributing catchment areas.

The presence of the OLFP's and flood plains as shown on Geomaps should be regarded as indicative only as the regional hydrological assessment has utilised LIDAR data which may not be reflective of current ground elevations. Furthermore, the high level (regional scale) hydrological assessment does not recognise localised features that could constrain the development of an OLFP or floodplain. Variation of actual site conditions to those shown can only be determined by detailed site walkover assessment and catchment analysis for each site, as would be required for comprehensive flood risk assessment for future development.

Detailed site walkover and review of the site condition should be carried out to confirm the suitability and practicality of installation of an onsite stormwater dispersal device as well as for comprehensive stormwater management assessment.

--- End of Report ---

Appendix A

Approved Title Plan

Title Plan - SO 544696

Survey Number	SO 544696
Surveyor Reference	30789/2-LINWOOD ROAD
Surveyor	Matthew Keith Adams
Survey Firm	Envivo Limited
Surveyor Declaration	I Matthew Keith Adams, being a licensed cadastral surveyor, certify that: (a) this dataset provided by me and its related survey are accurate, correct and in accordance with the Cadastral Survey Act 2002 and the Rules for Cadastral Survey 2010, and (b)the survey was undertaken by me or under my personal direction. Declared on 20 Dec 2019 03:45 PM

Survey Details

Dataset Description	Sections 1 & 2		
Status	Approved as to Survey		
Land District	North Auckland	**Survey Class**	Class B
Submitted Date	20/12/2019	**Survey Approval Date**	21/01/2020
		Deposit Date	

Territorial Authorities

Auckland Council

Comprised In

RT 468658

Created Parcels

Parcels	Parcel Intent	Area	RT Reference
Section 1 Survey Office Plan 544696	Legalisation	4.4400 Ha	
Section 2 Survey Office Plan 544696	Fee Simple Title	3.5756 Ha	
Area A Survey Office Plan 544696	Easement		
Total Area		8.0156 Ha	

Schedule / Memorandum

Land Registration District

North Auckland

Survey Number

SO 544696

Territorial Authority (the Council)

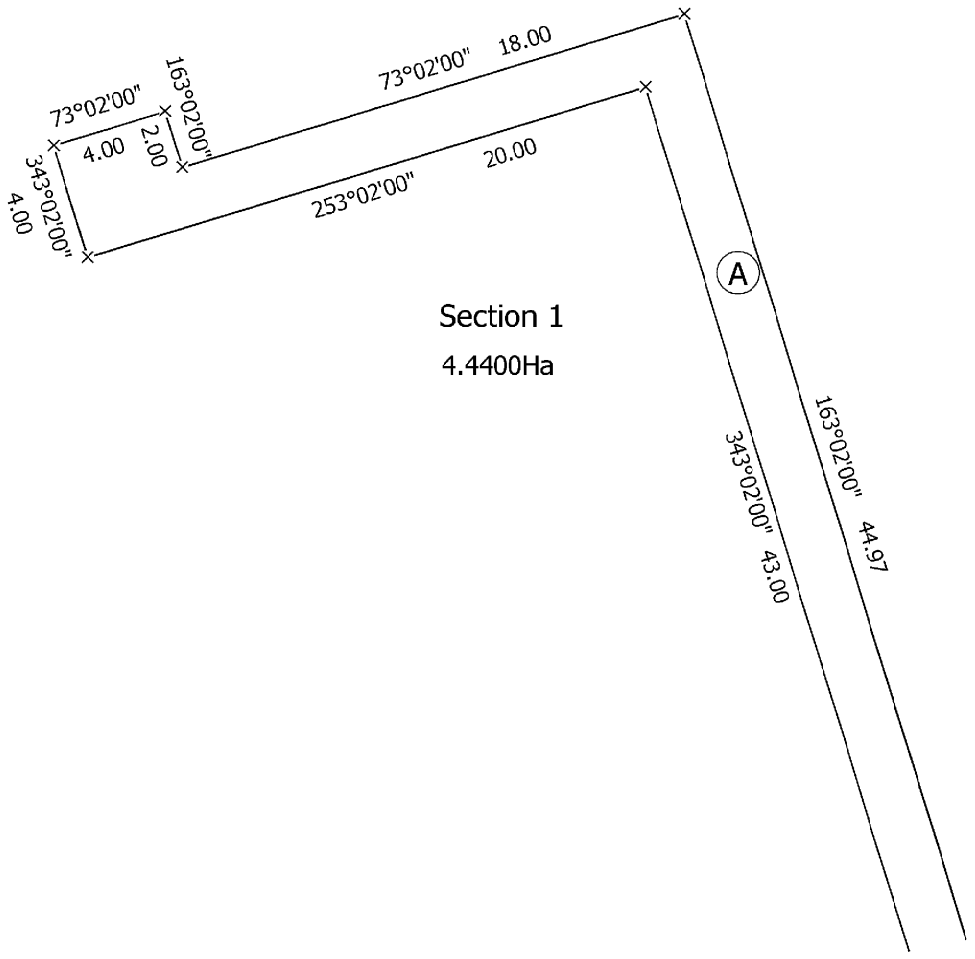
Auckland Council

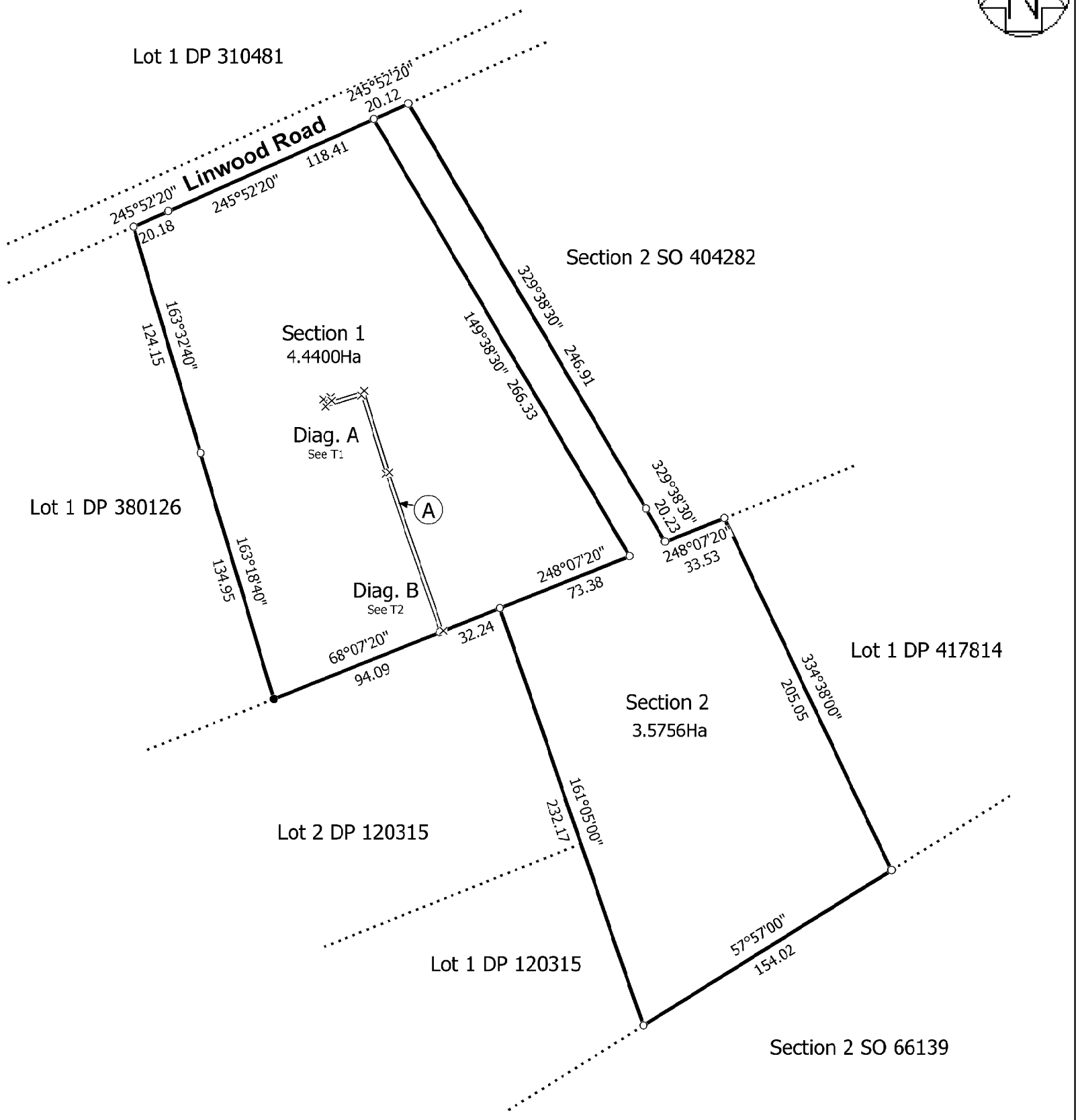
Schedule of Existing Easements

Last Edited: 09 Dec 2019 17:33:55

Purpose	Shown	Servient Tenement (Burdened Land)	Creating Document Reference
Right to convey water	A	Sect 1	TE B677903.2

Diag. A

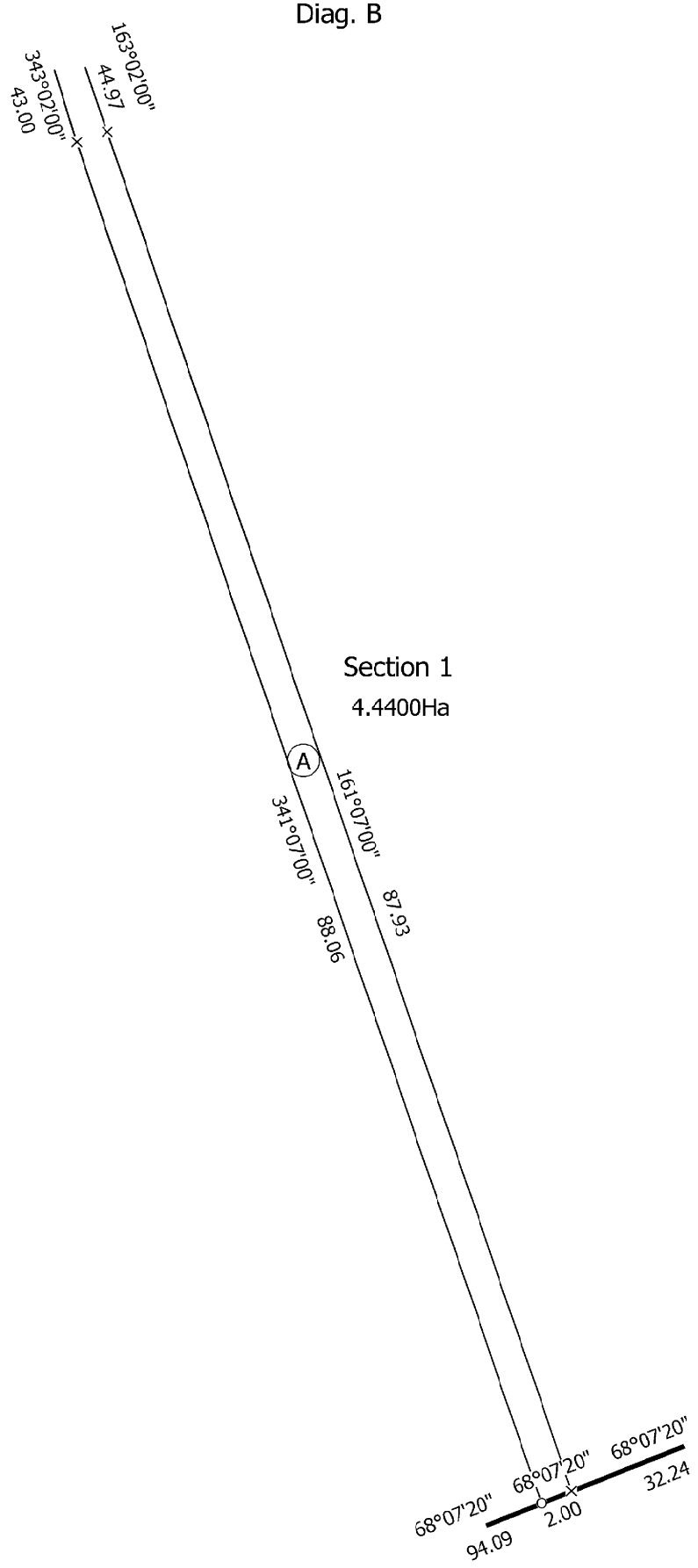




T 1/2

Land District: North Auckland Digitally Generated Plan Generated on: 21/01/2020 09:14am Page 3 of 4	Sections 1 & 2	Surveyor: Matthew Keith Adams Firm: Envivo Limited	Title Plan SO 544696 Approved on: 21/01/2020

Diag. B



Lot 2 DP 120315

T 2/2

Land District: North Auckland Digitally Generated Plan Generated on: 21/01/2020 09:14am Page 4 of 4	Sections 1 & 2	Surveyor: Matthew Keith Adams Firm: Envivo Limited	Title Plan SO 544696 Approved on: 21/01/2020

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Appendix B

Publicly Available Historic Aerial Images

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Retrolens

1942

Historic Aerial Photography

Soil&Rock Consultants
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Retrolens

1961

Historic Aerial Photography

Soil&Rock Consultants
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Retrolens

1974

Historic Aerial Photography

Soil&Rock Consultants
For well-grounded solutions

Retrolens

1981

Historic Aerial Photography

Soil&Rock Consultants
For well-grounded solutions

Retrolens

1988

Historic Aerial Photography

Soil&Rock Consultants
For well-grounded solutions

Auckland Council

2004

Historic Aerial Photography
Auckland Council GeoMaps

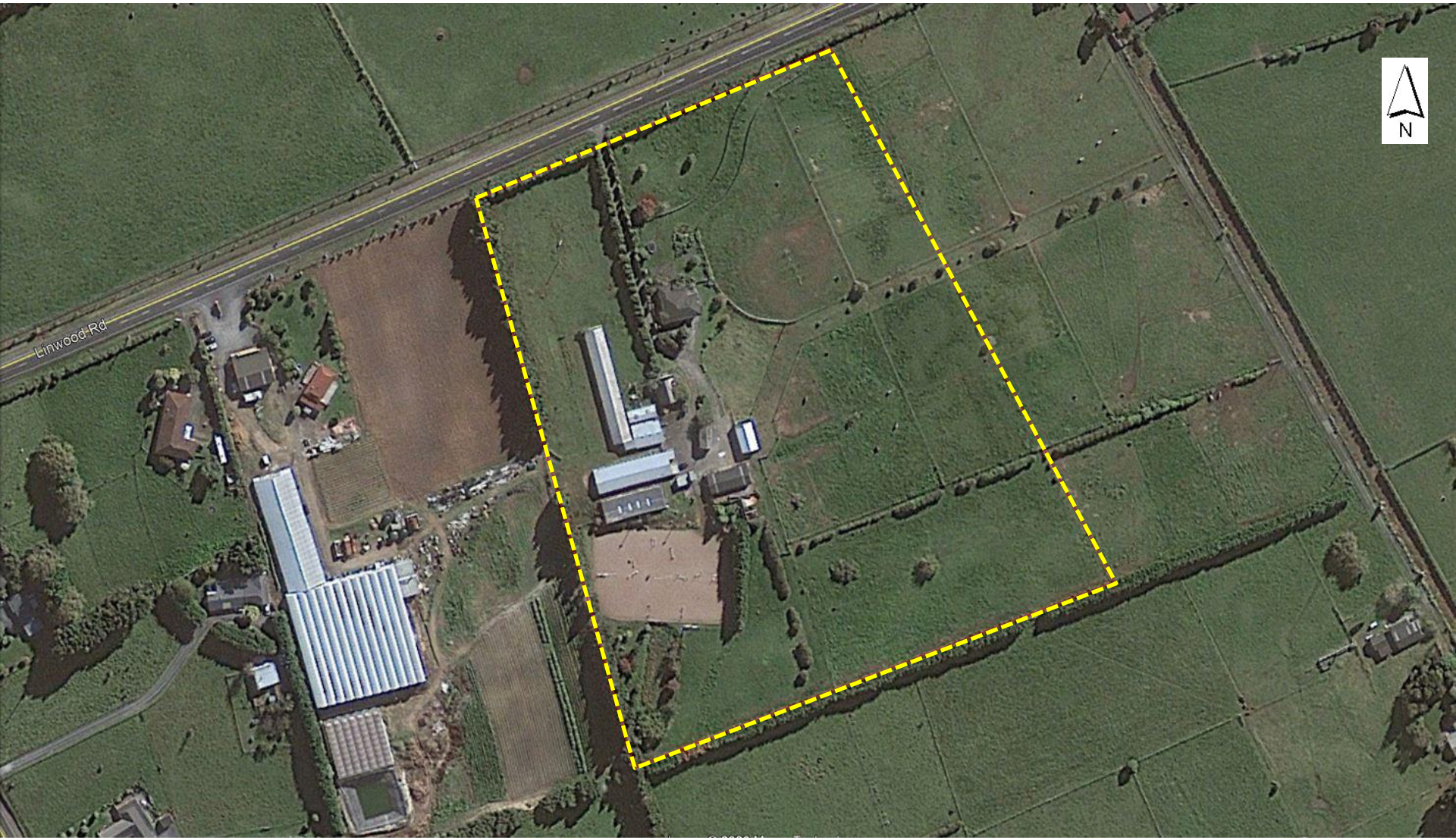
Soil&Rock Consultants
For well-grounded solutions

Auckland Council

2010

Historic Aerial Photography
Auckland Council GeoMaps

Job No. **20198** – 1043 Linwood Road, Kingseat (MoE Potential School Site)



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Google Earth

2012

Historic Aerial Photography

Google Inc.

Soil&Rock Consultants
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Google Earth

2013

Historic Aerial Photography
Google Inc.

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Google Earth

2015

Historic Aerial Photography

Google Inc.

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Google Earth

2017

Historic Aerial Photography
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Google Earth

2019

Historic Aerial Photography
Google Inc.